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Apple Blister-mite and Its Control

By

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Fig. 1. Blister-mite injury on pear and apple leaves: A. Pear leaf. B. Apple leaf. (After Lovett and Fulton.)

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Apple Blister-mite and Its Control

By

LEROY CHILDS,

Superintendent, Hood River Branch Experiment Station

Distribution and identity of species. The sudden and widespread dissemination of the apple blister-mite in the Pacific Northwest during the past two or three years, has occasioned much loss of fruit and has been of great concern to growers. During this time, many reports have been received indicating the seriousness of damage to fruit and leaves caused by this mite from numerous sections in British Columbia, the Yakima and Wenatchee districts, Spokane, Eastern and Southern Oregon, as well as in the Hood River Valley.

This extensive infestation possesses an interesting feature from a biological standpoint at least, in that the mite causing so much damage on apples is supposed to be the same organism so commonly found on pears. Students of this group of mites state that it is one and the same, *Eriophyes pyri* (Fig. 2). Curiously enough, blister-mites affecting pears have been known and reported on pears in all sections of the Northwest for years. This species is of European origin and was undoubtedly introduced at the time pears were first planted in this area and yet no infestation on apple of a serious nature was reported until quite recently. The writer's personal experience with the mite affecting pears in Oregon dates back eleven years. At that time in the Hood River Valley, pear trees were commonly and generally infested in all sections where spray was not employed for the mite's control. Many of these infested pear trees were found set at random through apple orchards. Regardless of this situation no infestation in the case of adjoining apple trees was observed for many years.

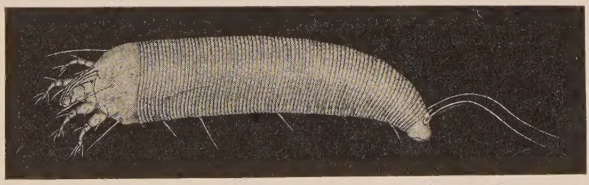

Fig. 2. Lateral view of the pear leaf blister-mite greatly enlarged. (After Parrott, et al., N. Y. Agr. Exp. Sta.)

The first infestation noted on apples occurred four years ago in an isolated upper valley orchard in which no pear trees were present. This orchard received little attention for three years, during which time it became seriously infested. In 1923 the damage caused by the mite was so great as to cause almost complete defoliation in August. The fruit was all severely russeted and of little value (Fig. 3). Another interesting feature in comparing apple infestation with that occurring on pears at the present time is the much more serious nature of the trouble on the former.

From a biological standpoint at least, all field information gathered to date seems to indicate that the mite affecting apples is a different spe-

cies or strain from the mite affecting pears. Yet mites themselves appear to be so nearly alike that specialists have been unable to distinguish one from the other. In an unsprayed orchard near Imbler, Oregon, the writer observed during the summer of 1921, an apple orchard practically defoliated by blister-mites. In the orchard were found several Bartlett pear trees, not a leaf of which was found to show the small blackish spots caused by this mite. At Yakima, Washington, during the past summer, further observations were made along this line. In a canyon, away from the main section of the Valley, was found an apparently abandoned apple and pear orchard. The trees were very large, probably forty or fifty years old. In many instances, the branches of the apple and pear trees interlocked. The apple trees were seriously infested, many leaves having already dropped, while on the pears only an occasional leaf was found showing injury from blister-mites—not as much as would be expected from ordinary blister-mite infestation where the trees were allowed to go unsprayed. On the other hand, many observations have been made in uninfested apple orchards during the past year where pear trees could be found rather generally attacked.

The nature of the spread of this pest in the different apple growing sections of the Northwest has been quite similar. Usually foothill or canyon orchards were the first to be found damaged by the mite. From these isolated orchards the mites have spread rapidly out onto the floors of the different valleys. This similarity of conditions suggests the possibility of there existing a native host plant from which the mite may have spread into the apple orchards of the different sections. Rather wide observations during the past summer point to the possibility that the snowberry (*Symphoricarpos racemosus*) may be the native host involved since it harbors a very similar if not identical mite and apple trees near infested snowberries were always found attacked. If this relationship, is definitely proved to exist, it will pay to eliminate the snowberry about orchards wherever practicable.

Habits and character of infestation. The blister-mites are not true insects. They are closely related to spiders, scorpions, and red-spiders of our fruit trees, chicken-mites and the like. The blister-mites are very small indeed, and on account of this minuteness are practically unknown to others than investigators. The largest known blister-mite measures about 1/80 of an inch in length, the smallest species about 1/250 of an inch. The size of the apple blister-mite can better be visualized by the fruit grower from observations made by the writer last year. During the course of study many buds were opened and the mites present counted by aid of the microscope. Often as high as six or seven hundred of these were found housed within a single fruit bud. Without the aid of the microscope the average observer would see nothing out of the ordinary. The mites are whitish in color, vermiform in shape, and possess four legs; their average length is about four times their width.

The habits of these minute creatures are of particular interest, though not all steps in the life cycle of mites affecting pears and apples are known. Based on the understanding we have of their behaviors, the proper sprays are recommended for the control of the pests. The mites pass the winter under the bud-scales of both fruit and leaf buds, particularly the former. In this location they are thoroughly protected from outside influences until bud activity begins in the spring. A majority of the mites are found under the third and fourth bud scales. During complete dormancy the outer bud scales fold over the third and fourth

scales in such a way as to prevent, to a large extent, the entrance of materials from the outside. With the approach of spring the buds begin to expand, and the mites within become much more exposed to outside influences. These influences on control will be discussed later.

Up to the present time investigators have believed that as the green tips unfolded the mites crawled out of the buds and burrowed into the new developing leaves. Observations carried on at Hood River last year indicate that a large proportion, if not all, of the new infestation

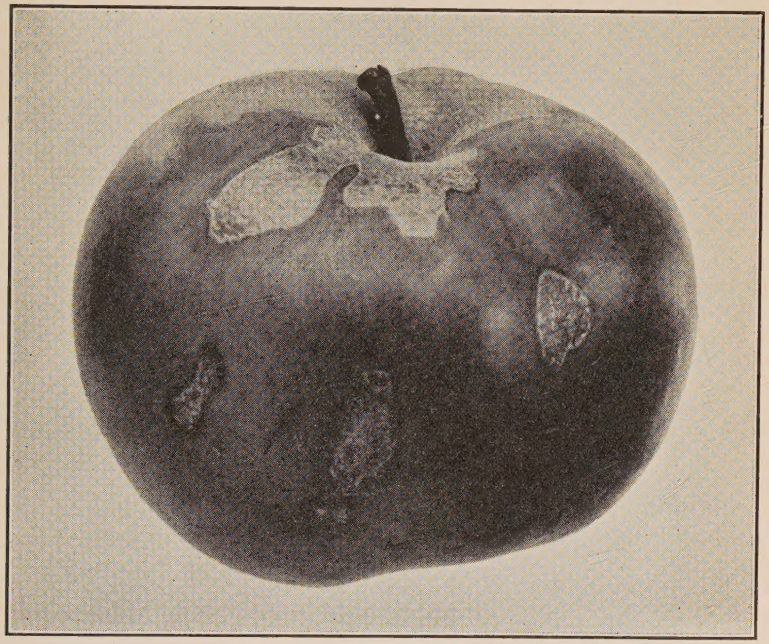

Fig. 3. Characteristic injury to apple caused by the blister-mite. Most of this damage occurs in the bud and blossom stage or shortly thereafter.

results from newly hatched mites, and that the eggs from which these hatch are deposited under the bud scales by the over-wintering mites. No over-wintering mites were found established in the new developing leaves.

Character of injury. In the course of a few days after the newly hatched mite enters the young leaf a visible blister or gall appears on the surface. Where the mites are numerous these little galls appear in large numbers. They are at first light green in color on the upper surface of the leaves with the same ground color as the leaf on the under surface. As the foliage ages, these blisters become darker and larger in extent due to the feeding of the colony of mites housed within, which can be found in all stages of development during early summer. This darkening and killing of the tissue is caused by the feeding of these little creatures, who work through the cells between the upper and under surface of the leaves. Where these galls are very numerous, the foliage becomes practically useless to the tree early in the summer, often falling during July and August.

The mites attack not only the young developing leaves, but also burrow into the flower buds and stems. The mites do not work long on the young apples but do so long enough to cause much damage. This injury appears later in the summer as a severe russet (Fig. 3). Often the apple is misshapen and where generally infested cracks open. Blister-mite apples seldom have more than a "C Grade" or "cooker" value and are often worthless.

Migration. After developing for a period within the tissues of the leaf, during which time several generations are doubtless produced, the mites begin to migrate from the leaves. The studies made in the Hood River Valley indicate that this migration begins much earlier than has been previously recorded. During the past summer mites were found going into winter quarters under the scales of the newly formed buds in the latter part of July. Early in August they were found in large numbers under the bud scales. This migration into winter quarters continues until the leaves fall.

Materials employed and notes on control. Extensive tests were conducted at the Hood River Branch Station during the past season (1924) in order to determine best methods of control and if possible to adapt the control of this mite to our present spray program. Included in this work were tests made with lime-sulfur and with oil at different strengths applied at different periods of bud development as well as oil combined with lime-sulfur and with bordeaux mixture. The determination of suitable strengths to effect control seemed particularly important at this time, especially from the standpoint of oil usage now that this material is being recommended at rather dilute strengths for scale control.

The results obtained during the past year can not be considered as complete, due to several inconsistencies in results obtained. Nevertheless, these results indicate several important points which should be recognized by growers in following out control measures. By just what means control is effected is not entirely known at the present time. Our studies indicate that the mode of killing of the mites is quite different in the case of the two common insecticides, lime-sulfur and oil, used for this purpose. Laboratory and field studies point to the fact that oil accomplishes results as an actual contact spray, and must do its work at the time of application or a very short time thereafter. This killing is accomplished by actual penetration of the oil under the bud scales themselves, where it comes in contact with the mites.

Because of this method of action, it is essential that growers recognize a few important points where oil is to be used for control purposes. The most important condition to keep in mind is that of bud development. As has already been stated, buds during the dormant season are for the most part sealed tight (Fig. 4-a), and it is with a great deal of difficulty that oil enters, especially under the fourth bud scale, where often many mites are hibernating. Oil applied under such conditions can not possibly give good results. A second consideration is also that of weather conditions. Early in the season, weather conditions are not altogether favorable for the application of oil. Warm weather greatly assists the oil in penetrating the buds. Growers who have used oil will remember how greasy and oily the trees appear when the days are warm and sunny. When this condition exists, one can usually expect good control of the blister-mite, provided, of course, that the buds

are in the proper stage, as well as good control of leaf-roller and brown aphids. In using oil for the blister-mite, spraying should be delayed until the buds begin to crack a little (Fig. 4-B). Pick out good weather and apply very thoroughly. Our observations indicate that a good miscible oil spray of not less than 5 percent should be used.

Fig. 4. Important stages in bud development which should be taken into consideration when applying sprays for blister-mite. A. Too early for the use of oil, but lime-sulfur can be used with good effect. B. Buds should develop to this point before applying oil; an excellent stage to apply lime-sulfur also. C. Too late for either oil or lime-sulfur.

In some of our tests last year the unsprayed trees developed 51.0 percent injured fruit, something over 20 percent of which was so seriously injured as to be of no commercial value. Where Dormoil* 3 to 100 was used, 28 percent of the fruit was damaged, approximately 10 percent of the damage being of a serious nature. Where a 6-to-100 dilution of the same material was used, 10 percent damage developed, a little more than 1 percent of which was serious. At a strength of 8 to 100, 4 percent of the fruit showed a trace of injury, little or none of which was unpackable.

*A western miscible oil running approximately 83 percent oil.

In all of the field tests conducted on a comparative basis, lime-sulfur proved to be the most effective material used in controlling the blister-mite. This was true regardless of time of application, though best results with this material were obtained as the buds were beginning to crack slightly. The actual killing process as accomplished by lime-sulfur is quite different from that obtained with the oil, and because of this difference a much wider time is possible over which the spray can be applied. Just how lime-sulfur prevents mite infestation is not altogether clear. In numerous observations made, mites have been found alive in the buds weeks after the application of spray has been given. In the case of dormant buds, as well as buds beginning to swell, lime-sulfur as a direct contact spray has little influence. This material does not penetrate under the bud scales as is true of the oil. On trees receiving lime-sulfur, a large percentage of the mites remain alive until the buds begin to expand, after which few if any can be found. The writer suspects that one or two things happen at this juncture: first, that sulfur fumes being thrown off, especially on sunny days, prove to be very toxic to the young mites, causing their death; and second, that in leaving the buds, the young mites possibly come into contact with small particles of spray material scattered about on the unfolding bud.

Regardless of the method of destruction, lime-sulfur properly applied can be counted upon to give excellent results. We have not definitely determined that a fall application on apples is as effective as one applied in the spring. It has proved to be so on pears. Last spring with the buds just beginning to swell, lime-sulfur used at the rate of 1 to 25 permitted 7.77 percent damage to the fruit; at 1 to 15, 3.19 percent, and at 1 to 10, 1.69 percent. In the two tests last mentioned the injuries were merely a trace. The unsprayed trees developed 51 percent injury.

Conclusions. The results in the year's work are outstanding in favor of lime-sulfur, due to the fact that the spray can be put on effectively over such a long period of time during the spring. In all orchards where the blister-mite is the outstanding pest and present in serious numbers, lime-sulfur should be used at the rate of 1 to 10 or, if scale is present, 1 to 8. In orchards where the mite has not reached serious proportions and there are present such other pests as leaf-roller and the brown aphid, an oil application of 8 to 100 is recommended. This must be applied only after the buds begin to crack slightly and preferably during warm, sunny weather (Fig 4-B).

No other pest demands more thorough spraying to effect control than the blister-mite. It must be remembered that, incased in a single bud, can often be found six or seven hundred mites. On an infested tree practically every bud harbors mites. Because of this condition existing, it is highly essential that every part of the tree be covered. This is particularly true of oil application, as oil must penetrate into each bud if the mites are to be destroyed. Our tests applied after the green portions of the buds were beginning to show were productive of very poor results in the case of both lime-sulfur and oil (Fig. 4-c). It is highly important that the spray be applied before the green tips appear. A very large percentage of the failures in blister-mite control coming to the attention of the writer have resulted from sprays applied too late. By getting the spray on in good season and spraying thoroughly the orchardist should have nothing to worry about as far as the blister-mite is concerned.